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After brain injury, neuroblasts generated from endogenous neural stem cells in the ventricular-subventricular zone of the lateral ventricle migrate toward the injured site using blood vessels as a scaffold, raising the possibility of reconstructing blood vessel network scaffolds as a strategy for promoting endogenous neuronal regeneration. In this study, we designed biomaterials based on the components and morphology of blood vessel scaffolds, and assessed their ability to guide the migration of neuroblasts into a brain lesion site in mice. Transplanted porous sponge containing components of the basement membrane (BM) matrix enhanced neuroblast migration into the lesion, and detailed morphological examination suggested that the infiltrating cells used the BM sponge as a scaffold. Laminin (LN)-rich porous sponge also enhanced the migration of neuroblasts into the lesion, whereas BM gel and gelatin porous sponge did not. We conclude that the transplantation of LN-rich porous sponge promotes neuroblast migration into cortical lesions. This study highlights the possibility of using artificial blood vessel scaffolds to promote the regeneration of injured cerebral cortex.